

## **General Instructions for Submission of FY 2004 DoD Challenge Project Proposal Packages**

An annual DoD Challenge Project activity was instituted in FY 1997 to ensure that the high performance computing (HPC) resources provided by the DoD High Performance Computing Modernization Program (HPCMP) are made available in a timely fashion to the DoD's highest-priority, highest-impact computational work. The HPCMP currently supports 39 FY 2003 DoD Challenge Projects (attached) sponsored by the Services and Defense Agencies at our four major shared resource centers and four allocated distributed centers. These projects are making great contributions to increasing our nation's military capability and our understanding of basic science and technology.

The program will continue to set aside approximately 25 percent of our total HPC resources to support DoD Challenge Projects. The combination of increased capability and the completion of some of our FY 2003 DoD Challenge Projects will allow the selection of approximately 10 to 12 new DoD Challenge Projects in FY 2004. Attached is the Call for FY 2004 DoD Challenge Project Proposals, which details the submission and selection process for proposers.

The DoD Challenge Project selection and resource allocation process is performed in accordance with the *DoD HPCMP Resource Allocation Policy*. This policy has been reviewed and endorsed by the HPC Advisory Panel (HPCAP), which is comprised of representatives appointed by each of the science and technology (S&T) and test and evaluation (T&E) executives. The allocation policy is used to ensure that the HPC resources provided by the HPCMP are expended in a manner consistent with the great value they represent in addressing high-priority Service/Agency projects. Technical evaluations are performed by the DoD Challenge Board, which is composed of the HPCAP and selected non-DoD technical experts from academia and other government agencies. The Director of the DoD HPCMP makes the final selection of new DoD Challenge Projects, working with the Deputy Under Secretary of Defense (Science and Technology), based on the technical evaluations and Service/Agency prioritizations.

For new FY 2004 proposals, multi-year projects for up to three years duration will again be considered. The multi-year projects will be re-evaluated after each year based on progress made, as will be done for the continuing projects from FY 2003. It is particularly important that application codes are fully developed and ready for use by each proposed project and that detailed justification is provided for the level of computational resources required.

Each Service/Agency should carefully prioritize the submitted proposals to ensure that they represent mission-critical, computationally intensive projects that can take full advantage of the substantial HPC capabilities at our shared resource centers. Challenge proposals spanning more than one HPCMP computational project or user organization are allowed, but it is essential that any multi-project proposals represent a coordinated, joint effort for which the synergism between projects is well documented, including a single management point-of-contact for the entire project. Proposals that appear to be aggregations of several projects for the purpose of exceeding minimum thresholds for Challenge Projects or to obtain better evaluations will not score well.

Please note that some high priority projects may be considered even if they do not meet the required minimum threshold on computational resources. Each Service should limit its submission of proposals for new DoD Challenge Projects to no more than ten. Participating Agencies should limit their submission of proposals to no more than five. Please ensure that proposals have the content and structure indicated in the attached call for proposals. Consistency of proposal content and format is essential to ensure fair, equitable, and consistent review. Any proposal that does not conform to the content and structure requirements will be returned without review. We are including in our technical evaluation process, for the first time, an additional clarification step that will allow technical reviewers to ask for limited, specific written clarification of proposals before the technical review is completed. However, this additional step does not substitute for the requirement for a complete, well-written proposal upon initial submission.

Please indicate the relative priority of each of your Service's or Agency's proposals based on the importance of the project to your Service or Agency. Assign each proposal a numeric score, with the restriction that a total of 100 points are awarded across your complete set of proposals, with no proposal being assigned less than five points. Send your FY 2004 DoD Challenge Project proposals in Microsoft Word 95 or later format to the DoD HPC Modernization Program Office (HPCMPO) at [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil). Proposals must be received from the Services/Agencies no later than **28 March 2003**.

As stated above, continuing, multi-year DoD Challenge Projects that were approved in previous years will be allocated resources in FY 2004 after an assessment of their progress is made by a subset of the DoD Challenge Board. This assessment will be made based on presentations at the 2003 DoD Users Group Conference (11-12 June 2003) and written progress reports. Consideration will also be given to extending HPC resources for up to an additional six months in FY 2004 for projects previously scheduled for completion in FY 2003. For this consideration, these projects must fulfill requirements for continuing, multi-year projects as documented in the rest of this paragraph. For each continuing project, in addition to the required presentation and written progress report, please submit to [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil):

1. a proposal cover page,
2. a DoD Challenge Project Resource Request (sample attached) for each additional year of the project (FY 2004 and FY 2005) (only ONE resource request per project per year), and
3. a short statement of project objectives for FY 2004 (not to exceed one page).

Submissions for your continuing projects (including any requests for extensions) must all be received by **28 March 2003**. In addition to prioritizing all of your new project proposals as discussed above, please indicate relative priority of your new project proposals compared to your continuing projects.

The points-of-contact for this activity can be reached by e-mail at [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil).

Attachments:

1. FY 2003 DoD Challenge Projects
2. Call for FY 2004 DoD Challenge Project Proposals
3. Computational Resources Available for FY 2003 DoD Challenge Projects
4. DoD Challenge Project Resource Request
5. Sample Proposal Cover Page

## **FY 2003 DoD Challenge Projects**

### **Projects Ending in FY 2003**

1. Multi-scale Simulations of High Temperature Ceramic Materials
2. Airborne Laser Challenge Project II
3. Submerged Wakes in Littoral Regions
4. Time-Accurate Computational Simulations of Ship Airwake for DI, Simulation and Design Applications
5. New Materials Design
6. Unsteady RANS Simulation for Surface Ship Maneuvering and Seakeeping
7. Directed High Power RF Energy: Foundation of Next Generation Air Force Weapons
8. Coupled Mesoscale Modeling of the Atmosphere and Ocean
9. Large-Eddy Simulation of Steep Breaking Waves and Thin Spray Sheets Around a Ship
10. Active Control of Fuel Injectors in Full Scale Gas Turbine Engines
11. Three-dimensional, Unsteady, Multi-Phase CFD Analysis of Maneuvering High Speed Supercavitating Vehicles
12. One Thirty-Second Degree Global Ocean Modeling and Prediction
13. Applied Computational Fluid Dynamics (ACFD) in Support of Aircraft-Store Compatibility and Weapons Integration
14. Multiphase CFD Simulations of Solid Propellant Combustion in Modular Charges and Electrothermal-Chemical (ETC) Guns
15. Airdrop System Modeling for the 21st Century Airborne Warrior
16. Characterization of DoD-Relevant Materials and Interfaces

### **Projects Continuing into FY 2004**

1. Signature Modeling for Future Combat Systems
2. High Fidelity Analysis of UAVs Using Nonlinear Fluid/Structure Simulation
3. High-Fidelity Simulation of Littoral Environments
4. Seismic Signature Simulations for Tactical Ground Sensor Systems and Underground Facilities
5. Multiscale Simulation of Nanotubes and Quantum Structures
6. Multi-Scale Simulations of High Energy Density Materials
7. Basin-scale Prediction with the Hybrid Coordinate Ocean Model
8. Time Accurate Aerodynamics Modeling of Synthetic Jets for Projectile Control
9. Computational Chemistry Models Leading to Mitigation of Gun Tube Erosion
10. Large-Eddy Simulation of Tip-Clearance Flow in a stator-Rotor Combination
11. Evaluation and Retrofit for Blast Protection in Urban Terrain
12. First Principles Studies of Technologically Important Smart Materials
13. Three-Dimensional Modeling and Simulation of Weapons Effects for Obstacle Clearance
14. Numerical Modeling of Turbulent Wakes for Naval Applications
15. 3-D CFD Modeling of the Chemical Oxygen-Iodine Laser II
16. Simulation of Coherent Radar Backscatter from Dynamic Sea Surfaces
17. Modeling Complex Projectile-Target Interactions II

18. Defense against Chemical Warfare Agents (CWAs) and Toxic Industrial Chemicals (TICs):  
Filtration, Prophylaxis and Therapeutics
19. Multidisciplinary Applications of Detached-Eddy Simulation to Separated Flows at High  
Reynolds Numbers
20. Computational Support for Chemically Reactive Flows and Non-ideal Explosives
21. Time Accurate Unsteady Simulation of the Stall Inception Process in the Compression  
System of a US Army Helicopter Gas Turbine Engine
22. Stochastic Simulations of Flow-Structure Interactions
23. Towards Predicting Scenarios of Environmental Arctic Change (TOPSEARCH)

## Call for FY 2004 DoD Challenge Project Proposals

### Introduction

This is a call for proposals for large, computationally intensive projects that require the use of DoD High Performance Computing Modernization Program (HPCMP) shared resource center systems. Successful proposals receive allocations of computational time on HPCMP shared resource systems. The High Performance Computing Modernization Program Office (HPCMPO) has designated approximately 25% of total HPCMP computational resources to be allocated for these large projects, referred to as DoD Challenge Projects.

*Definition:* DoD Challenge Projects may require resources across multiple hardware platforms and may span multiple shared resource centers. An approximate minimum central processing unit (CPU) requirement for projects is 50 gigaflops-years annually, equivalent to approximately 80,000 processor-hours on an IBM Regatta P4, 350,000 processor-hours on an SGI Origin 3000 or a Cray T3E, or 220,000 hours on an HP SC45. This approximate threshold should be considered as a guideline for proposal purposes. Services and Agencies may submit DoD Challenge Project proposals for high-priority projects with annual requirements considerably less than this threshold to ensure greater participation in the Challenge Project proposal process. All DoD Challenge Project proposals must meet the same standards for scientific and computational merit.

*Eligibility:* All computational scientists and engineers in DoD science and technology and test and evaluation programs who are eligible to use HPCMP resources under its current guidelines may submit DoD Challenge Project proposals.

*Submission:* Proposals must be submitted through the Service/Agency High Performance Computing Advisory Panel (HPCAP) principals to the HPCMPO. Although DoD Challenge Project proposals are due to the HPCMPO from the Service/Agency principals by 28 March 2003, each Service and Agency has established or will establish earlier internal deadlines for submission so that proposals can be screened and prioritized prior to sending them to the HPCMPO. The HPCMPO requires proposals in Microsoft Word 95 or later format by email. The internal deadlines and where to send the proposals are:

Air Force: Internal submission deadlines and guidelines will be published separately.  
Contact [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil) for further information.

Army: By COB Monday, 17 March 2003, Army activities must submit a prioritized list of proposals and proposal documents in electronic format (Microsoft Word 95 or later) to [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil). Arrangements for classified submissions should be made directly to the above email. An Army level committee will recommend overall Army prioritization of proposals.

Navy: By COB Friday, 14 March 2003, Navy activities must submit proposals in Microsoft Word 95 or later format by email to [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil).

DTRA: Internal deadlines and procedures will be provided at a later date.

MDA: By COB Friday, 21 March 2003, MDA activities must submit proposals and proposal documents in Microsoft Word 95 or later format by email to [require@hpcmo.hpc.mil](mailto:require@hpcmo.hpc.mil). Arrangements for classified submissions should be made directly to the email above.

C3I (NIMA): Internal deadlines and procedures will be provided at a later date.

DARPA: Internal deadlines and procedures will be provided at a later date.

*Questions:* Please contact the HPCMPO via email [require.hpcmo.hpc.mil](mailto:require.hpcmo.hpc.mil).

*Evaluation:* The DoD Challenge Board will technically evaluate and recommend proposals for implementation to the HPCMPO. The Challenge Board consists of representatives from each of the Services and DoD Agencies as appropriate. The board also includes technical experts outside of the DoD.

*Awards:* Award announcements are planned for July 2003.

*Consideration:* Proposals submitted for the FY 2004 evaluation may be either one-year proposals or multi-year proposals (two or three years). FY 2004 DoD Challenge Project allocations will be provided for the entire fiscal year beginning 1 October 2003. Allocations for successful multi-year proposals for FY 2005 and FY 2006 will be made after a review of FY 2004 progress as part of the FY 2005 DoD Challenge Project proposal evaluation process.

## **Proposal Contents**

Proposals are limited to 15 pages (single-spaced, standard 12-point font, one-inch margins). It should be noted that the cover page, resource request, and curriculum vitae do not count toward the 15-page proposal limit. Proposals will be structured such that they contain the following sections in the order given. Each proposal should address each and every point in all eight sections. **Proposals that do not conform to this structure will be returned without further evaluation.**

*Cover Page:* This section should provide a brief description of the following (in one page). Please refer to the sample cover page provided as an attachment:

- *Title:* Title of the project.
- *CTA:* List the computational technology area (CTA) to which the project belongs.
- *Project Leader:* List the name of the project leader.
- *Government Point of Contact:* List the name of the Government Point of Contact for the project.
- *Sponsoring Service/ Agency and Organization:* List the Service/Agency and organization sponsoring the Challenge Project.

- *Technical Goals*: Provide broad technical goals of the Challenge Project.
- *Specific objectives*: Specify specific objectives of the project.
- *Technical Approach*: Describe the technical approach.
- *Major Applications Software*: List major applications software proposed for use, including any CHSSI codes ([www.hpcmo.hpc.mil/Htdocs/CHSSI/software.html](http://www.hpcmo.hpc.mil/Htdocs/CHSSI/software.html)).
- *Technical and Computational Challenges*: Describe technical and computational challenges to be encountered in the course of the project justifying DoD HPC resources.
- *DoD Impact*: Specify DoD impact of the Challenge Project computations.
- *Schedule*: Specify the years for which HPC computational resources are requested.
- *Keywords*: Summarize keywords used in the proposal.

The contents of this cover page will be used in high-level DoD presentations.

1. *Introduction*: This section should be used to introduce the project and put it in perspective in broad, general terms. Include a general discussion of ongoing related work in both your organization and the entire scientific, technology, and testing community.
2. *Justification/DoD Relevance*: This section will be used primarily to assess the mission relevance of this proposed project and determine its Service/Agency mission priority. Clearly state the military relevance of the project and what current and future DoD weapons systems it will support, if any. Show how the computational work in this proposed project supports the science and technology or developmental test and evaluation program of DoD and/or your laboratory or test center, respectively. State the military advantage to be gained by exploiting HPC capability in this project.
3. *Technical Approach*: **This section is the heart of the proposal.** Ensure that both computational science and computer science issues are discussed. Clearly state the technical goals of the project and lay out a program plan for achieving those goals. Estimate the size of the group to be working on the project and name the key players. State clearly whether the project proposed is a one, two, or three-year effort and for each year provide a schedule with estimated milestones and anticipated accomplishments. Describe the computational methodology and algorithms, estimating the size of the problem as specifically as possible. Discuss specifically the operational/ production level status of software to be used by the project, particularly the software's efficiency on scalable systems by stating its performance as a function of degree of parallelism. It is particularly important that application codes to be used on this project be fully developed and ready to use from the project's start. Show evidence that the software is well optimized and operates efficiently and responsibly in an environment where resources are shared. Discuss technical and computational challenges to be encountered in the course of the project.
4. *Progress to Date*: If this is an existing computational project, discuss your progress to date in this section of the proposal. Elaborate on any HPC resources located at any of the shared resource centers that were utilized by this project or efforts leading up to this project. Discuss what remains to be done on this project and why it must now be done as a DoD Challenge Project.



5. *Required Resources and Justification:* Fully justify computational resources required to accomplish this project in terms of total processor hours on specific HPCMP systems for FY 2004. **A list of these available systems is attached.** As we complete our FY 2003 investments, additional HPC capability is expected to be available for FY 2004 DoD Challenge Projects. We will update the list of HPC systems in the attachments on the HPCMP Web site (<http://www.hpcmo.hpc.mil>) as they are announced. Documenting known run times on the same architecture as proposed for the project best provides detailed justification for the required level of computational resources. Provide good estimates of the number of known runs of the type required for the project. Also provide justification for the number of runs requested. If the effort requires larger runs than have previously been made, provide a reasonable estimate of run times for these larger runs based on known scaling laws for the particular algorithms being used, if available. Include and justify memory, storage, networking, and software requirements. **To be eligible for consideration as a DoD Challenge Project, the proposal must contain a well-thought-out estimate of the computational resources required.**

For a multi-year project, provide estimates of second- and third-year requirements based on first-year estimates. Please include one, and only one, *DoD Challenge Project Resource Request* form for each year of support requested. Consideration for continuation of the project for its second and third year will include a re-evaluation of out-year estimates from this original proposal and actual utilization.

Proposals may present two or more options for utilizing HPC systems at the shared resource centers. *The requirements stated in this DoD Challenge Project proposal **must** be included in the HPCMP's requirements database as updated in the most recent requirements update process.* Explain any major differences between the resources requested for this DoD Challenge Project and those previously stated on the project's requirements analysis questionnaire.

6. *Computational Summary Sheet:* A completed *DoD Challenge Project Resource Request* must accompany each proposal. A consolidated request for resources for the DoD Challenge Project is required; do not provide multiple requests for individual sub-projects, if any. Section II of this summary sheet, which contains computational, memory, and secondary storage (all temporary disk space required while a job is running) requirements, must be completed for each option and each year described in the resources section of the proposal. Thus, each summary sheet must contain at least one set of its two tables for each year of the proposed work. The computational project titles and project numbers may be obtained from your organization's Service/Agency Approval Authority. For Challenge Project proposals that span multiple computational projects, provide an estimate of the percentage of resources that will be used by each of the component computational projects.
7. *Curricula Vitae:* Include a *curriculum vita* for each of the key personnel, with a relevant publication list.

## **Proposal Evaluation**

*Criteria:* Proposals will be judged on the following criteria:

1. DoD mission priority,
2. Military advantage gained by exploiting HPC,
3. Scientific merit of the proposed project,
4. Computational merit of the proposed project,
5. Potential for significant progress, and
6. Appropriateness of requested resources for the proposed project.

*Process:* Proposals will be evaluated technically by the DoD Challenge Board. The board consists of representatives from each of the Services and DoD Agencies as appropriate. The board also includes representation from outside of DoD. Each proposal will be evaluated and prioritized in terms of its mission relevance (“DoD mission priority” and “military advantage gained by exploiting HPC” criteria) individually by its Service or DoD Agency. The HPCMP Director will consider both the technical evaluation and the mission relevance evaluation in constructing a set of recommended DoD Challenge Projects.

## Schedule

Date	Action
17 January 2003	HPCMPO issues call for FY 2004 DoD Challenge Project proposals and requests for FY 2004 allocations for continuing DoD Challenge Projects
28 March 2003	New FY 2004 DoD Challenge Project proposals due to HPCMPO  Requests for FY 2004 allocations for continuing DoD Challenge Projects due to HPCMPO  Services and Agencies have earlier internal deadlines
28 March – 27 June 2003	Review process <ul style="list-style-type: none"> <li>• Initial analysis by HPCMPO</li> <li>• Evaluation of new proposals by Challenge Board</li> <li>• Review of progress of ongoing Challenge Projects by Challenge Board</li> <li>• Development of recommendations by HPCMPO</li> <li>• Selection by Director, HPCMP and DUSD (S&amp;T)</li> </ul>
July 2003	FY 2004 DoD Challenge Projects announced by Director, HPCMP
1 October 2003	Implementation of FY 2004 DoD Challenge Projects at HPC centers

**DoD High Performance Computing Modernization Program**  
**Computational Resources**  
**Available for FY 2004 DoD Challenge Projects**  
**(Will Be Updated on Web Site as New Systems Are Announced)**

<b>Location</b>	<b>DoD HPCMP System</b>	<b>Number of Processors</b>
Army Corps of Engineers Engineer Research and Development Center (ERDC)	SGI O3K	512
	Cray T3E	1,888
	Compaq SC40	512
	Compaq SC45	512
	New System	
Naval Oceanographic Office (NAVO)	Cray SVlex	64
	IBM Regatta P4	1184
	IBM SP P3	1,280
Army Research Laboratory (ARL)	SGI O3K	512
	IBM SP P3	1,024
	IBM Regatta P4	64
	SGI O3K (Classified)	256
	IBM Regatta P4 (Classified)	736
Aeronautical Systems Center (ASC)	New System	
	Compaq SC40/SC45	900
	IBM SP P3	512
Army High Performance Computing Research Center (AHPCRC)	Cray T3E	1,024
	New System	
Arctic Region Supercomputing Center (ARSC)	Cray T3E	256
	Cray SVlex	32
	New System	
Maui High Performance Computing Center (MHPCC)	IBM SP P3	716
	IBM Netfinity Cluster	512
	IBM SP P3 (Classified)	160
	New System	
Space and Missile Defense Command (SMDC)	SGI O2K	176
	SGI O3K	96
	SGI O21K (Classified)	128
	Cray SV1e	16

## DoD Challenge Project Resource Request

**Project Title:**

**Section I:**

### Project Leader Identification

Name: \_\_\_\_\_

Service/Agency: \_\_\_\_\_

Organization: \_\_\_\_\_

Address, City, State, and Zip Code: \_\_\_\_\_

E-Mail Address: \_\_\_\_\_

Phone: (\_\_\_\_) \_\_\_\_\_ DSN: \_\_\_\_\_ Fax: (\_\_\_\_) \_\_\_\_\_

### Section II: Overall Project Resource Requirements

Platform(s)	Location		CPU Resources (processor-hours)	
	First Choice	Second Choice	Request	Minimum Acceptable

Platform(s)	Typical Number of Processors	Maximum Number of Processors	Typical Job Memory (GB)	Maximum Job Memory (GB)	Typical Job Secondary Storage (GB)	Maximum Job Secondary Storage (GB)

### Section III: Related Requirements Computational Project(s)

Related Requirements Project Title(s): \_\_\_\_\_

Related Requirements Project Number(s) and Percentages of Work to be Performed by Each:

\_\_\_\_\_

## Sample Proposal Cover Page

*Title:* Time Accurate Computational Simulations of Ship Airwake for DI, Simulation and Design Applications

*CTA:* CFD

*Project Leader:* Susan Polsky

*Government Point of Contact:* Susan Polsky, (123) 456-7890, email address

*Sponsoring Service/ Agency and Organization:* US Navy, Naval Air Warfare Center, Aircraft Division (NAWCAD), Patuxent River, MD 20670

*Technical Goals:* Prediction and characterization of the unsteady nature of the airwake produced by US Navy Ships.

*Specific Objectives:* Time accurate CFD computations to predict and characterize the unsteady nature of the airwake produced by a US Navy LHA-class ship and an UH-60A helicopter.

*Technical Approach:* The CFD simulations will be computed at full-scale conditions with second-order time accuracy and assuming fully viscous flow. Turbulence is modeled using the Monotone Integrated Large Eddy Simulation (MILES) approach. The parallel solver used, COBALT, was developed by the Air Force with CHSSI funding. The calculation will be performed using unstructured grids.

*Major Applications Software:* Cobalt<sub>60</sub> (CHSSI)

*Technical and Computational Challenges:* The flow is dominated by massively separated regions and vortices. It is imperative that the modeled vortices not be allowed to dissipate prematurely due to numerical issues. The scales involved range from 1/100<sup>th</sup> of an inch resolution in boundary layers to as much as 1000ft from bow to stern of the ship. This, coupled with rather complicated geometries, presents significant gridding challenges. Ship wake flows are inherently unsteady requiring time accurate computations. The solutions will require access to massively parallel machines in order to meet the computational and memory demands of the problem.

*DoD Impact:* Weapons systems benefiting from the proposed work include LHA-class amphibious ships, the Army UH-60A helicopter, and the V-22 tilt rotor and the JSF, both of which will operate from an LHA platform. In addition, this technology can be applied to carriers and carrier based fixed-wing aircraft. This work will also enhance manned-flight simulation by providing computed, time-accurate ship airwake data for state-of-the-art flight simulation. In the future, this work could impact new ship design, ship modification for improved flight operations and accident assessments.

*Schedule:* FY 2001, FY 2002 and FY 2003

*Keywords:* Ship Airwake, Dynamic Interface (DI), Simulation, Time-Accurate, Large Eddy Simulation (LES), Navier-Stokes solutions, Unsteady flows, Unstructured grids, LHA, Wind-over-Deck (WOD), Vortices, and Turbulent flow